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| 09/656,017 | 09/07/2000 | Louis F Aprigliano | 82627 | 2288 |

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| EXAMINER | |
|---|---|
| LIN, KUANG Y | |
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Please find below and/or attached an Office communication concerning this application or proceeding.

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| APPLICATION NO./ CONTROL NO. | FILING DATE | FIRST NAMED INVENTOR / PATENT IN REEXAMINATION | ATTORNEY DOCKET NO. |
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**Commissioner for Patents**

In view of the communication by the Board of Patent Appeals and Interferences mailed August 25, 2003 the amendment filed on September 12, 2002 had been physically entered. A full text translation of JP 63-33,594 by the PTO translator is attached. Also, the following is the correct copy of claims 5 and 6 under appeal:

5. In a method of casting a ductile alloy having a base metal by heating thereof to produce a molten stream that is atomized into a spray of droplets directed onto a moving substrate surface; the improvement residing in: selecting a corrosion resisting material as a component of the alloy undergoing said heating; exclusively limiting said alloy to the base metal and the corrosion resisting material; and utilizing an inert cover gas to atomize the molten stream into said spray of droplets for deposit onto said surface to increase in strength the ductile alloy from a yield strength of less than 145 ksi.

6. The method as defined in claim 5, wherein said base metal is nickel, the corrosion resisting material is chromium and the inert cover gas is nitrogen selected to effect said increase in strength of the ductile alloy with ductility improved from less than 25% tensile elongation.

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EXAMINER
GROUP 320
1725

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Japanese Published Unexamined (Kokai) Patent Publication No. S63-33594; Publication Date: February 13, 1988; Application No. S61-174835; Application Date: July 25, 1986; Int. Cl.[4]: C25D 7/06; Inventor(s): Takeshi Kusunomi et al.; Applicant: Tokushu Denkyoku Corporation; Japanese Title: Denki Aen Mekki Souchi-you Kondakuta Rooru (Conductor Roller for an Electro-galvanizing Device)

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Specification

1. Title of Invention

Conductor Roller for an Electro-galvanizing Device

2. Claim(s)

1. A conductor roller for an electro-galvanizing device, characterized in that the conductor roller body is made of a composition that contains Ni and Cr at 40 to 60% each as main components.

2. A conductor roller for an electro-galvanizing device, as disclosed in Claim 1, characterized in that the conductor roller body is produced by using an electroslag casting.

3. Detailed Description of the Invention

[Field of Industrial Application]

This invention pertains to improved conductor rollers for electro-galvanizing devices. In particular, this invention relates to conductor rollers that are used in the electro-galvanizing field at iron mills.

[Prior Art]

The electro-galvanizing devices used at iron mills are equipment for producing zinc plating steel plates by a continuous electrolytic zinc plating means using cold rolling thin plates and hot rolling thin plates as raw materials. Strip steel plates in which rolling oil is completely removed by applying a predetermined pretreatment are fed into the plating devices. An acid bath is usually given. In particular, a zinc sulfate bath is widely used. Ammonium chloride and sodium chloride are added into the bath so as to reduce the bath resistance other than zinc sulfate. Aluminum sulfate is also sometimes added so as to improve the smoothness of the surfaces of the steel plates and the uniformity of the electrodeposition. As for anodes, pure zinc is conventionally used as soluble anodes. In the recent years, insoluble electrodes are used in lieu of soluble anodes because they require a replacing time. With the insoluble electrodes, zinc ions are supplied from the outside via electrolyte.

Generally, there are two types of plating tanks: a vertical type; a horizontal type. By arranging the conductors between both types, an electric conduction is applied to the strip steel plates. Since these conductor rollers are in contact with the zinc sulfate bath, electric corrosion is significant. Because the rollers are the most critical components in the electro-galvanizing devices, various studies for improving the materials and the usable life are conducted in various fields by sampling a large number of materials.

At the current technological stage, a Ni-Cr-Mo material (CVN-Ni: 63%, Cr: 18% and Mo: 17% or Inco 625-Ni: 58%, Cr: 22%, Mo: 9%, Nb: 4% and Fe: 4%) is primarily used as the material, typically as Hasteroi C (Ni: 65%; Cr: 17%; Mo: 17%).

[Problem of Prior Art to Be Addressed]

Accordingly, the producing costs for prior art conductor rollers and the materials are extremely high with respect to the structure also (12000000 yen or higher at the current price). Incorporating the maintenance fees for detachment, polishing and assembly due to electric corrosion and the limitation in the number of polishing operations, the total cost required for the rollers results in a serious problem along with high power consumption.

The present invention is developed so as to solve the problem. The invention also aims to offer a conductor roller for an electro-galvanizing device that can reduce the cost for the plating by improving the durability of the roller by improving the material thereof and that can prevent the interruption of the equipment operation by the period required for maintenance.

[Measures to Solve the Problem]

In order to achieve the purpose, the inventors of the invention first actually immerse the following materials into electrolyte, which are assumed to be strong to an acid bath. The reduction in the amounts of the materials due to corrosion is measured:

1. Electrode: insoluble electrode

2. Electrolyte: zinclyte

3. Immersing time: 33 hours

4.Sample materials (quantity indication: %)

| | Ni | Cr | Mo | Co | W | Nb | Fe |
|---|---|---|---|---|---|---|---|
| Hasteroi C<br>Inconeru 625<br>Inconeru | (Please refer to the original | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 50Ni-50Cr<br>50Ni-50Cr (S-R)<br>SUS 316L<br>Stelyte #66 | description<br>) | | | | | | |

As a result, it is identified that the reduction level of the immersion is ordered from (1) Hasteroi C, (2) 50Ni-50Cr, (3) SUS 316L, (4) 50Ni-50Cr (S-R), (5) Inconeru 825, (6) Inconeru 625 to (7) Stelyte #66 from higher to lower. It is evident that Stelyte demonstrates highest corrosion resistance. However, this type of Co group materials involve an extremely high cost and demonstrate insufficient casting fitness. In contrast, 50Ni-50Cr has electrocorrosion resistance, high hardness and abrasion resistance. For these reasons, the invention adopts a conductor roller for an electro-galvanizing device, whose body is made of a composition that contains Ni and Cr at 40 to 60% each as the main components.

[Effect]

As the conductor roller body of the invention is made of the material with the above composition, it demonstrates high electrocorrosion resistance, high abrasion resistance and extremely high durability.

[Embodiment]

The embodiment of the invention is described hereinbelow with reference to an electroslag casting device as illustrated in Fig.2. In Fig.2, reference number 1 refers to a wire real; 2 to a wire; 3 to a wire feed in-out device; 4 to a nozzle; 5 to an inner casting water cooling contact metal; 6 to an outer ring water cooling contact metal; 7 to a starting block for starting an electroslag casting operation; 8 to a seat for the starting block. Seat 8

and starting block 7 are provided so as to lower at a predetermined casting speed. Reference number R refers to a conductor roller body for a sleeve electro-galvanizing device in the formation.

The following conditions are applied for the electroslag casting to produce the conductor roller of the invention using the aforementioned device:

| | | |
|---|---|---|
| Wire to be used | ET-NCR-50 | 3.2 mmϕ |
| Flux to be used | ANF-6 (by Russia) | |
| Welder | RES-1 12 electrodes | Rocking type |
| Current | 450 to 600 Amp/pole | |
| Voltage | 40 to 45 V/pole | |
| Wire feeding speed | 2.5 m/min | |

The disadvantage of a conventional centrifugal casting such as an insufficient casting quality due to the material of 50Ni-50Cr is not seen at all in conductor roller body R that is composed of a 50Ni-50Cr composition, which is produced according to the device and the conditions. The insufficient casting quality refers to abnormal roughness and fine cracks occurred to the texture on the surface of the roller body. Thus, conductor roller body R maintains excellent quality as follow. The surface is smooth and extremely normal in terms of the texture. No impurities and gases are generated. No defects occur, such as cracks.

A comparison in the results after the 50Ni-50Cr electro-galvanizing conductor roller of the invention and prior art Ni-Cr-Mo conductor roller have been put to the practical use as references is indicated in the following table. It is evident that the conductor roller of the invention has a much higher quality in the durability than that of prior art conductor roller.

| | Product of the invention | Prior art product |
|---|---|---|
| Polishing frequency | Once per 90 to 100 days | Once per 40 to 50 days |
| Number of maximum polishings | 15 to 18 times | 10 to 13 times |
| Service life | 1350 to 1800 days | 400 to 650 days |

[Advantageous Result of the Invention]

As disclosed above, according to the electro-galvanizing device conductor roller of the invention, the durability of the roller significantly improves due to the improved material. The operation efficiency also improves because the time required for the maintenance is reduced. As a result, the cost required for the electro-galvanizing is drastically reduced. As the roller surface is smooth and normal in terms of the texture, a significantly positive effect is brought to the electro-galvanizing plating for steel plates.

Furthermore, when the electroslag casting is used for the invention, the effect further improves. It is also easier for the conductor roller to be recycled.

4. Brief Description of the Invention

The drawings illustrate the embodiment of the invention. Fig.1 is a perspective view illustrating a conductor roller body. Fig.2 is a schematic diagram illustrating a conductor roller body during a production using an electroslag casting device.

R...Conductor roller body for an electro-galvanizing device

Translations Branch
U.S. Patent and Trademark Office
9/08/03
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